REMARKS

Claims 1-9 and 28 are pending herein. Claims 10-27 have been cancelled without prejudice or disclaimer. Claims 1 and 2 have been amended as supported by Figs. 1(a) and 1(b), for example. Claim 9 has been amended for clarification purposes only.

Applicant appreciates the indication that claim 4 would be allowed if rewritten in independent form. Although Applicant does not acquiesce to the art-based rejections of record discussed below, pending claim 4 has been rewritten in independent form as new claim 28. For the reasons explained below, pending independent claims 1 and 2 are also believed to be allowable over the applied prior art of record.

1. Applicant affirms the provisional election to prosecute claims 1-9. Claims 10-27 have been withdrawn from consideration as being drawn to non-elected invention, and thus have been cancelled without prejudice or disclaimer. Applicant reserves the right under 35 § USC 121 to file a divisional application for the non-elected claims.

2. The objections to the drawings and specification in paragraphs 2-4 of the Office Action are noted, but deemed moot in view of the new formal drawings of Figs. 4-7 filed herewith and substitute specification paragraphs submitted above.

3. Claims 1, 2 and 5-9 were rejected under §102 over GB 979,811 (GB '811). To the extent that this rejection might be applied against the amended claims, it is respectfully traversed.

Pending independent claim 1 recites that a ceramic base and a metallic member are bonded to one another. An active metal foil is disposed on a surface of the ceramic base and an Au solder material is disposed on the active metal foil. Claim 1 has been amended to recite that the Au solder material is disposed directly on the active metal foil. The active metal foil and the solder material are heated to form a bonding layer, onto which the metallic

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member is positioned. The metallic member and the bonding layer are pressed together and heated to bond the bonding layer and the metallic member to one another through solid phase bonding.

The composite member recited in pending independent claim 2 is similar to the composite member claimed in claim 1 with the exception that the solder material is an Au-Ag alloy. Pending claim 2 has also been amended to recite that the Au-Ag solder alloy is disposed directly on the active metal foil.

Bonding ceramic and metallic members to one another is somewhat problematic, for example, mismatching between the coefficients of thermal expansion of the ceramic base and the metallic member often results in the formation of cracks in the ceramic member. This is especially evident in conventional liquid phase bonding methods. For instance, in the case that an AlN ceramic member is bonded to an Ni alloy metallic member using an Au solder material as a bonding agent, the Au solder material is liquified and interacts with the Ni alloy metallic member to form an Au-Ni alloy located between the AlN ceramic member and the Ni alloy metallic member. Upon hardening of the Au-Ni alloy, the AlN ceramic member is prone to suffering cracking due to an increase in stress imparted to the AlN ceramic member from the excessive diffusion of an Ni solid solution (from the Ni alloy member) into the liquified Au solder material.

In contrast to the above-discussed conventional liquid phase bonding method, solid phase bonding of the ceramic and metallic members to one another is carried out at a temperature lower than the melting point of the solder material, which provides a soft, non-liquified layer of solder on the ceramic member bonding surface. Thus, a solid solution portion of the metallic member and the solder material do not mix with one another. This, in turn, prevents an increase in stress application to the ceramic member by preventing an

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excessive amount of the metallic member solid solution from diffusing into the non-liquified solder material. Accordingly, a composite member formed using solid phase bonding (as claimed) is provided with enhanced resistance against thermal cycling and thermal shock because the ceramic member is not damaged (see paragraphs [0034-0037] starting on page 15 of the present specification).

With reference to Fig. 1 of GB '811, a first metallic layer 3 forms a molten layer between a ceramic part K and an intermediate metallic layer 2, and a second metallic layer 1 (an Au-Ni alloy) forms a molten layer between a metallic part M and the intermediate metallic layer 2. The intermediate metallic layer 2 is a solid layer (Ni) separating the first and second molten metallic layers 3 and 1, respectively, from one another.

Fig. 1 of GB '811 shows that a solid layer (intermediate metallic layer 2) separates the first and second molten metallic layers 3 and 1, respectively, from one another. As such, the intermediate metallic layer 2 prevents the second metallic layer 1 (i.e, a solder material) from being "disposed directly on" an active metal layer (i.e., the first metallic layer 3). In contrast to Fig. 1 of GB '811, pending independent claims 1 and 2 each recite that "a solder material comprising Au is disposed directly on the active metal foil." Again, the active metal layer 3 and the solder layer 1 shown in Fig. 1 of GB '811 do not directly contact one another.

With reference to Fig. 2 of GB '811, a metallic part M and a ceramic part K are bonded to one another using a bonding region including a first metallic layer 10 and a second metallic layer 9. A portion of the surface layer of the metallic part M (Au) is alloyed with a portion of the second metallic layer 9 (Cu) to form an alloy zone (Au-Cu; see page 4, column 2, lines 97-98 of GB '811).

Fig. 2 of GB '811 clearly shows that the bonding region includes an Au-Cu alloy zone formed between the metallic part M and the solder metal layer 9 (i.e., second metallic layer).

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Pending independent claims 1 and 2 each recite that the metallic member and the bonding layer are bonded to one another "through solid phase bonding." Accordingly, there is no alloy formed between a solid solution portion of the metallic member and a liquified solder material. Therefore, since the bonding layer is not liquified and alloyed with a portion of the metallic member, the stress buffering characteristics of the soft Au solder material prevent cracking of the ceramic member. That is, the stress buffering characteristics of the claimed solder material are not decreased due to the excessive diffusion thereinto of a solid solution portion of the metallic member.

For all of the foregoing reasons, reconsideration and withdrawal of the §102 rejection over GB '811 are respectfully requested.

4. Claims 1, 6, 7 and 9 were rejected under §102 over Sato et al. To the extent that this rejection might be applied against the amended claims, it is respectfully traversed.

With reference to Fig. 2 of Sato, a piezoelectric/electrostrictive (P/E) ceramic 1 is bonded to metallic mounting plate 4 via bond metallicized layer 3 and solder layer 5. The bond metallicized layer 3 includes active layer 3a (e.g., zirconia) adjacent to P/E ceramic 1 and a barrier layer 3b (e.g., platinum or nickel) separating active layer 3a from solder layer 3c (e.g., Au or Ag).

Similar to Fig. 1 of GB '811 discussed above, solid barrier layer 3b intervenes between active layer 3a and solder layer 3c (see column 4, lines 62-64). In contrast to Sato, pending independent claim 1 recites that the solder material is disposed directly on the active metal foil. It is clear from Fig. 2 of Sato that Au or Ag solder layer 3c is not disposed directly on active layer 3a. Again, barrier layer 3b separates the solder and active layers from one another.

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In view of the foregoing, reconsideration and withdrawal of the §102 rejection over Sato et al. are respectfully requested.

5. Claims 1, 6, 7 and 9 were rejected under §102 over Maroni. To the extent that this rejection might be applied against the amended claims, it is respectfully traversed.

With reference to Fig. 1 of Maroni, a non-metallic portion 11 (e.g., glass or ceramic) is bonded to metal substrate 15. A metal layer 12 (e.g., Au or Ag) is in contact with non-metallic portion 11 and intervenes between metallic bonding agent 13 and non-metallic portion 11 (see column 3, lines 15-21).

Maroni discloses that a portion of substrate 15 (e.g., copper, aluminum, etc...) and metallic bonding agent 13 react to form a stable intermediate phase or solid solution (column 3, lines 21-27). In contrast to Maroni, pending independent claim 1 recites that the bonding layer and the metallic member are bonded to one another "through solid phase bonding." Solid phase bonding means that bonding is carried out at a temperature lower than the melting point of the solder material, which, in turn, prevents the metal components constituting the metallic member from dissolving into the bonding layer to form a solid solution (see specification page 16, paragraph [0036]). Moroni's disclosure of a solid solution formed between portions of metal substrate 15 and bonding agent 13 does not disclose or suggest the claimed "solid phase bonding" feature.

In view of all of the foregoing, reconsideration and withdrawal of the §102 rejection over Maroni are respectfully requested.

6. Claim 3 was rejected under §103(a) over GB '811. As correctly understood by the PTO, GB '811 does not disclose the content of Ag in the claimed Au-Ag alloy. This is because GB '811 discloses the use of Au-Ni and Au-Cu alloys, and not Au-Ag as claimed. In any event, the deficiencies of GB '811 with respect to pending independent claim 2 have been

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discussed above. Since claim 3 depends directly from claim 2, claim 3 is also believed to be allowable over GB '811. Accordingly, reconsideration and withdrawal of this rejection are requested.

If the Examiner believes that contact with Applicant's attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicant's attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

Kevin C Brown

April 15, 2003
Date

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